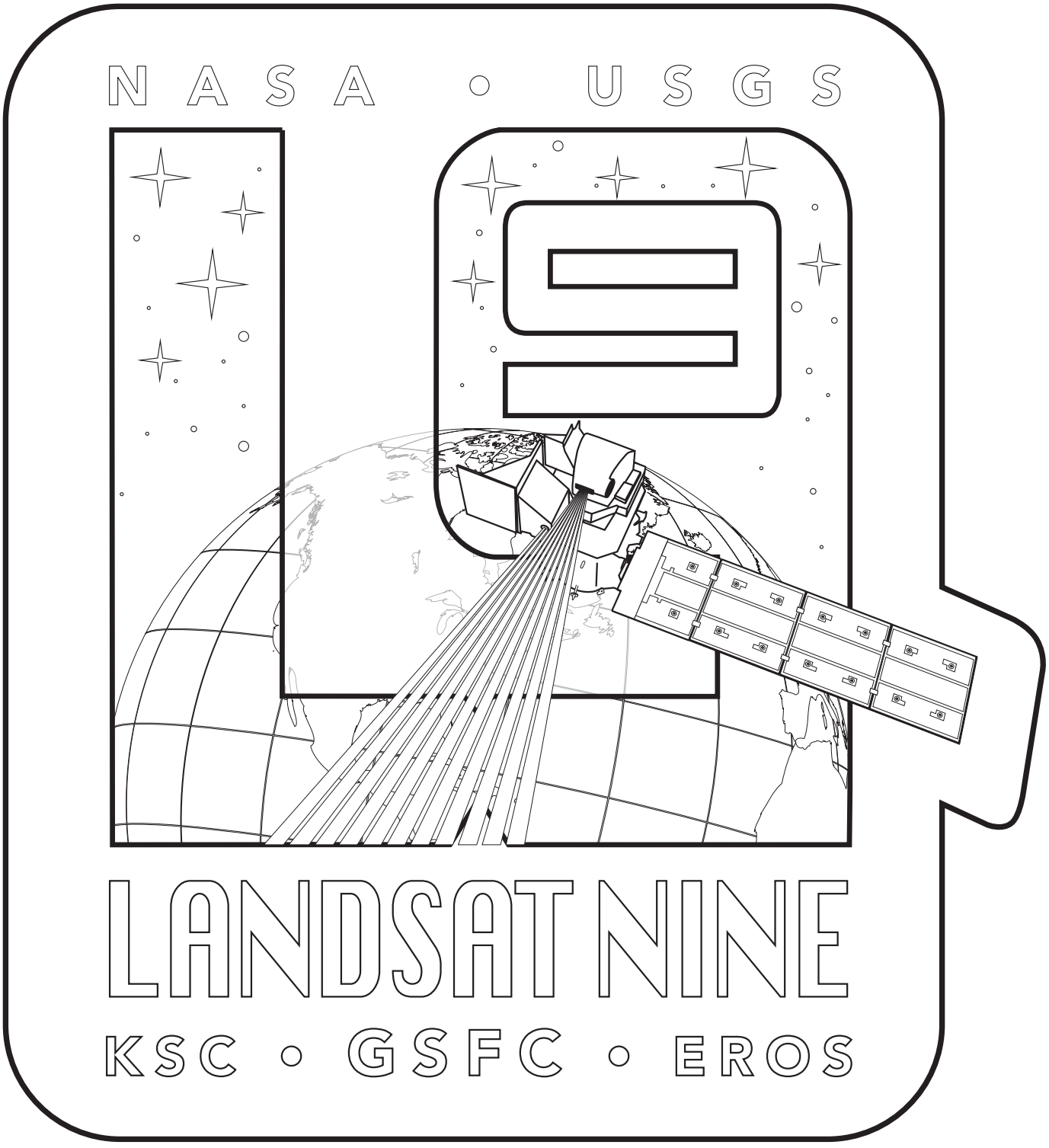

NASA
USGS
science for a changing world
LANDSAT 9

Contents

Landsat 9 Mission Logo

Landsat 9 is the latest satellite in the Landsat program, which is a collaboration between NASA and the United States Geological Survey (USGS). It is scheduled to launch in 2021 and we're really excited to see it go! Landsat lets us look at Earth from space, and since the first satellite was launched in 1972, it has given us lots of information about our changing planet. We use Landsat images to look at the world's forests, oceans, deserts, lakes, cities, and so much more. There's a lot to learn about these satellites, and a lot that we can learn from them!

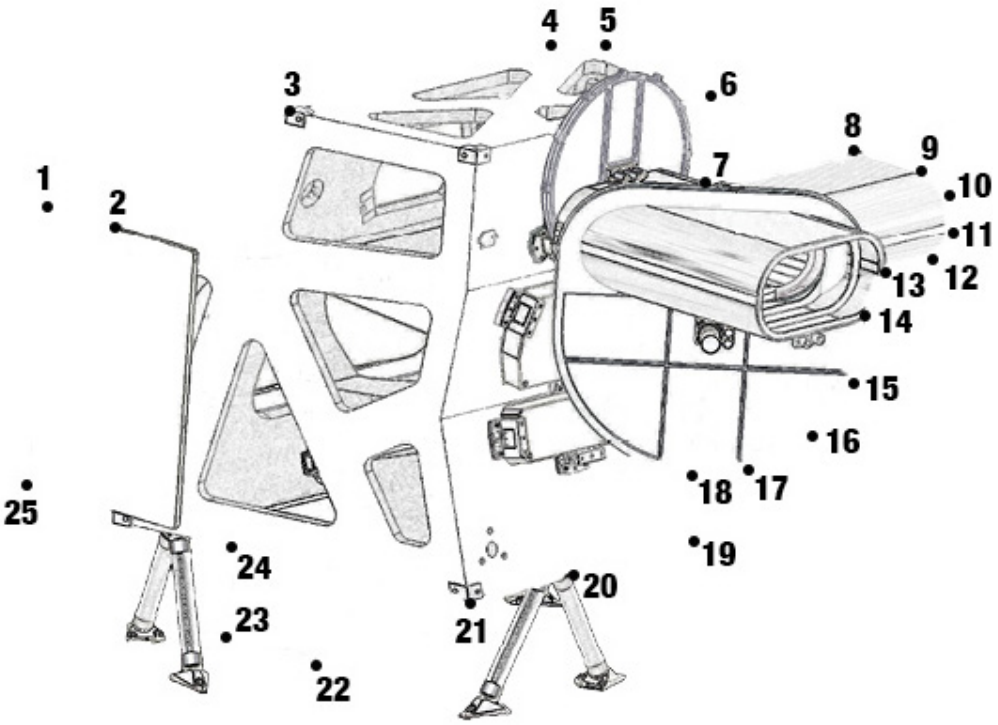


Color in the official Landsat 9 Mission Logo!

Landsat 9 Instruments

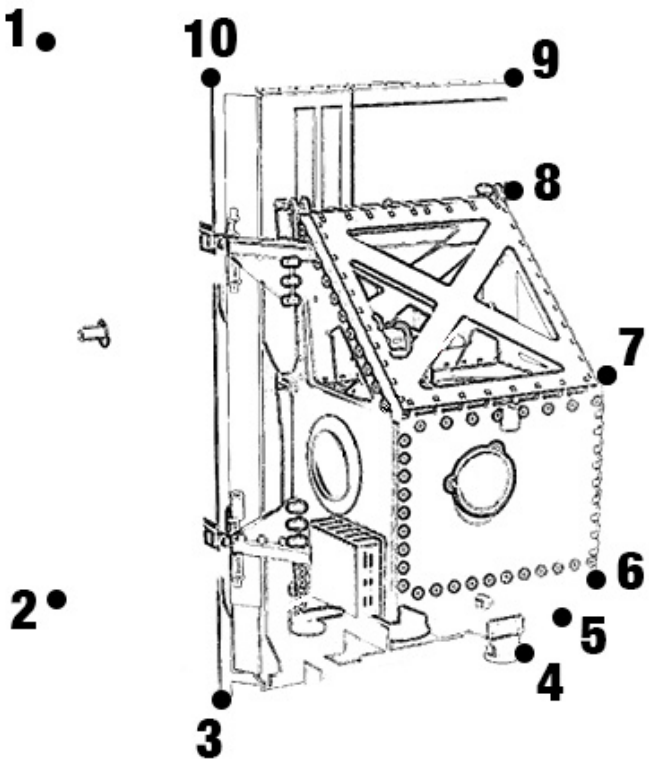
Landsat 9 will have two science instruments on board, called sensors. These will gather information about Earth from far away - a process called remote sensing.

Connect the dots to help NASA finish building the scientific instruments for Landsat.



OLI-2 stands for the **O**perational **L**and **I**mager **2**. This instrument will measure light energy as it is reflected off of the Earth. The data that OLI-2 collects can be turned into images, which will add to the record of Earth that Landsat has been creating since 1972.

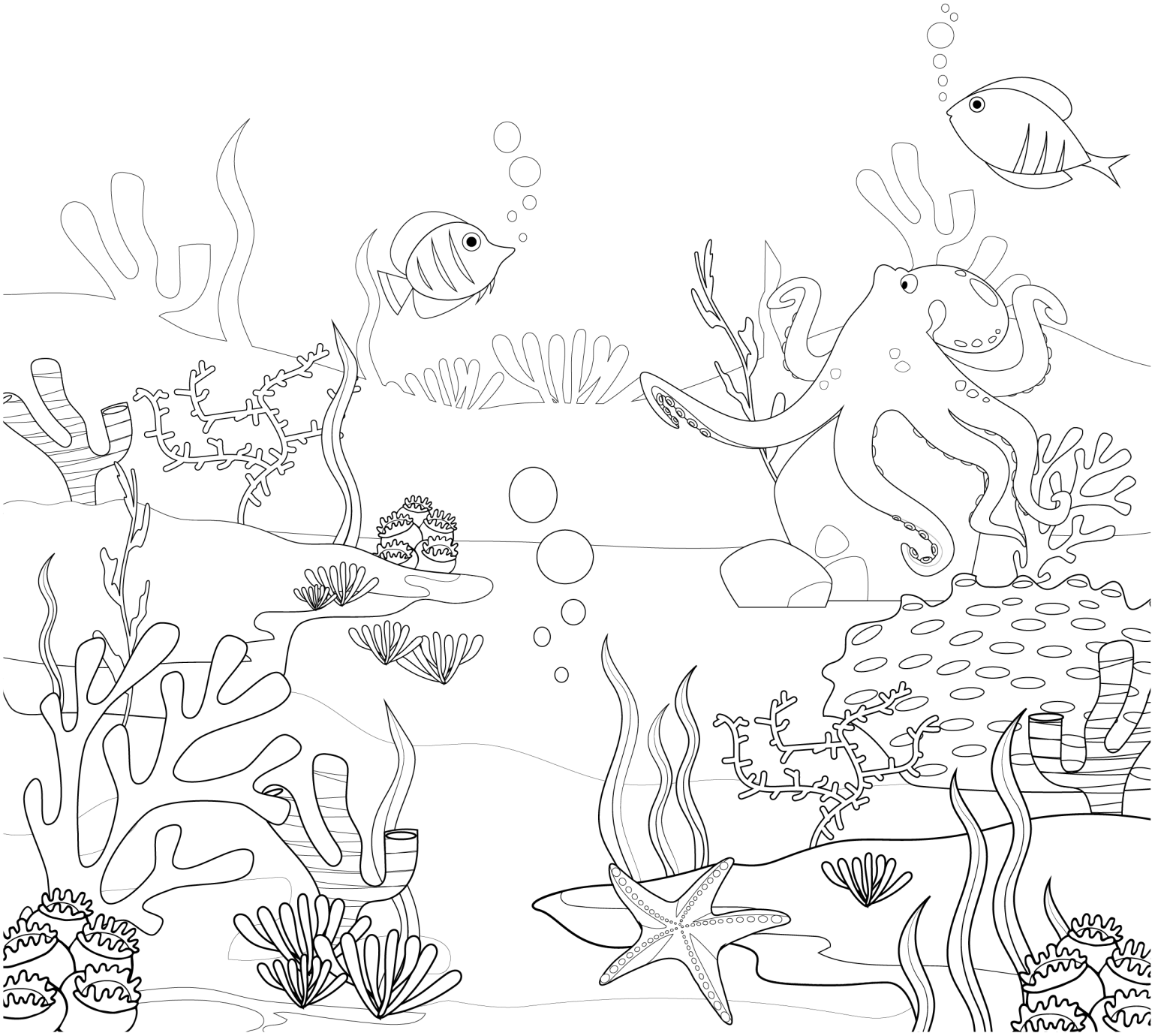
The **T**hermal **I**nfrared **S**ensor **2**, or **TIRS-2**, will measure and record the temperature of Earth's surfaces. Scientists can use this information to detect wildfires and monitor the health of lakes, as well as track changes in temperature over a long period of time.



Landsat & Coral Reefs

Landsat has helped us better understand coastal regions around the world for nearly 50 years. Now, Landsat 9 is ready to carry on that record, chronicling our home planet. It will study coral reef degradation by enabling continued global monitoring of Earth's reefs.

Color in this deep sea scene!



Landsat & Rainforests

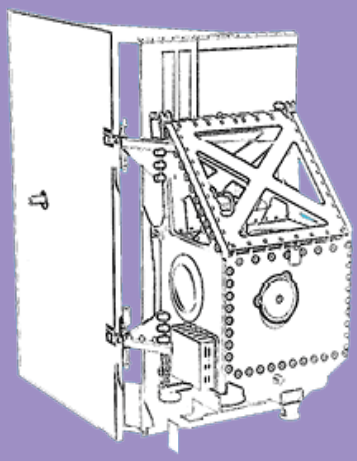
We know how forests around the planet are changing thanks to Landsat. There are many new insights about global tree-cover that Landsat has given us. Landsat 9 is ready to keep that tradition going. It will study the earth in a way that will help world leaders make decisions about tropical deforestation and global forest dynamics.

Color in this tropical forest scene!

Launch Maze

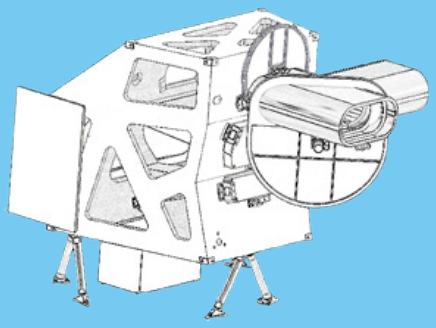
Before Landsat 9 can launch, there are lots of parts that need to be picked up from all across the country and put together.

A



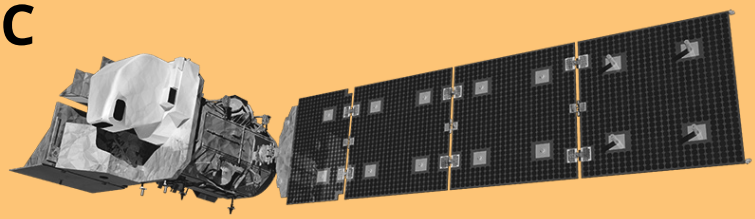
First, TIRS-2 has to be picked up from Maryland. TIRS-2 will be an improved version of Landsat 8's TIRS, but the design is similar. The original TIRS had a small problem that made its measurements less accurate, but engineers fixed the issue on TIRS-2, which will be shipped to Arizona. As many as 250 engineers helped create this instrument!

B



Then, OLI-2 has to be collected from Colorado. The OLI-2 design is a copy of Landsat 8's OLI, but OLI-2 has been updated to provide greater depth of imagery. This will be useful for looking at the dark parts of Earth. OLI-2 has thousands of photosensitive detectors to help it create colorful images. It will be carefully shipped to Arizona.

C

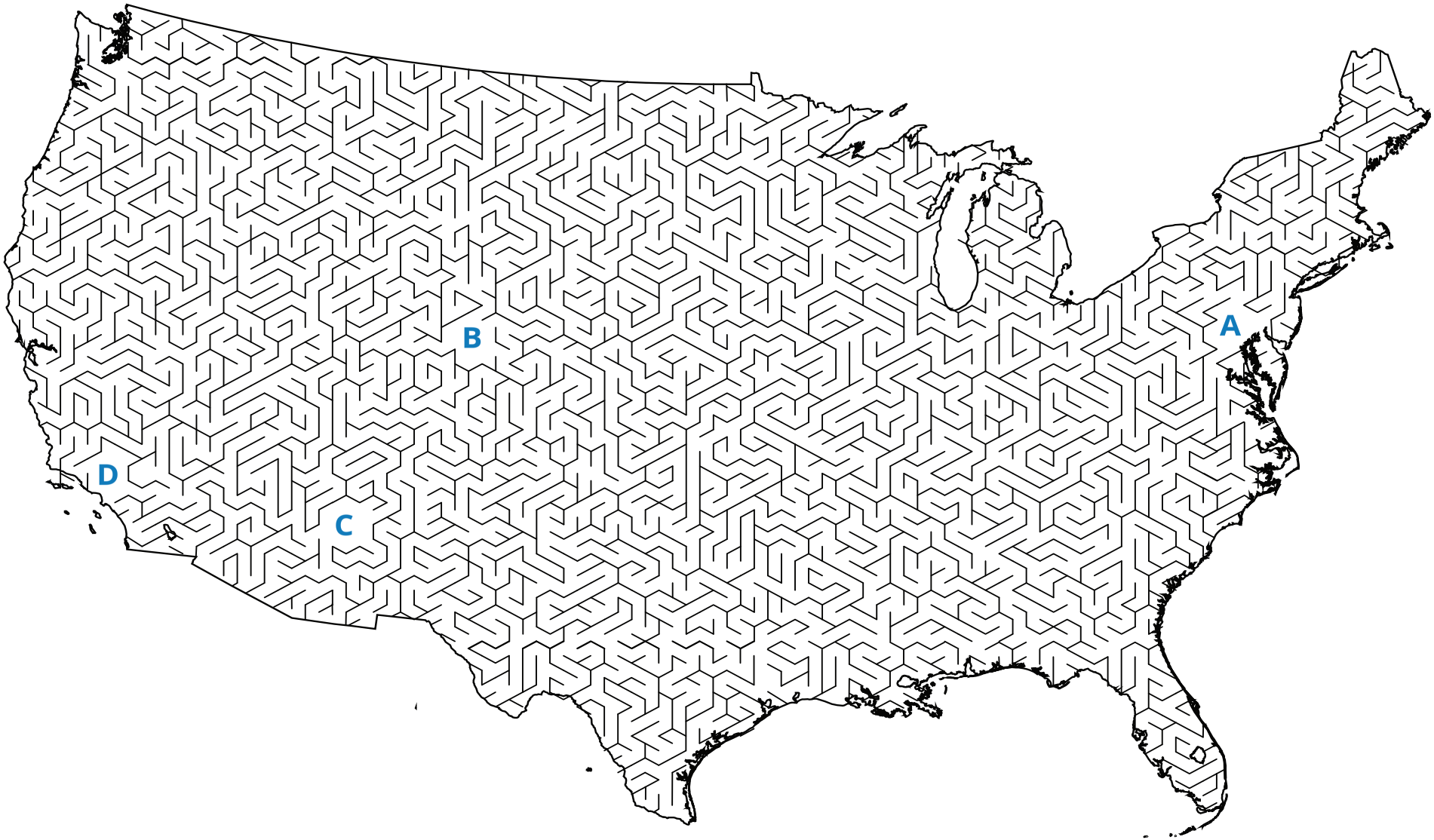


Next, OLI-2 and TIRS-2 need to be attached to the spacecraft, which contains important parts like the solar array, which collects energy from the Sun to power the satellite. Put together, the whole satellite is about the height of a giraffe and the length of a school bus! It will be tested over and over to make sure everything works properly.

D

Finally, after the spacecraft and instruments are loaded onto a special environmentally controlled truck for their journey to California, where they will be launched into space by a Atlas V rocket!

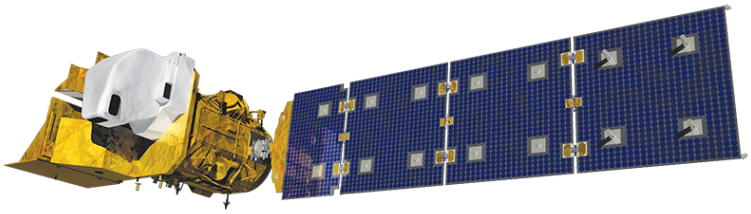
Make your way through the maze to collect everything NASA needs for Landsat 9! Start by collecting TIRS-2 at A, pick up OLI-2 at B, and then head over to C for the spacecraft and testing before making your way to D to launch!

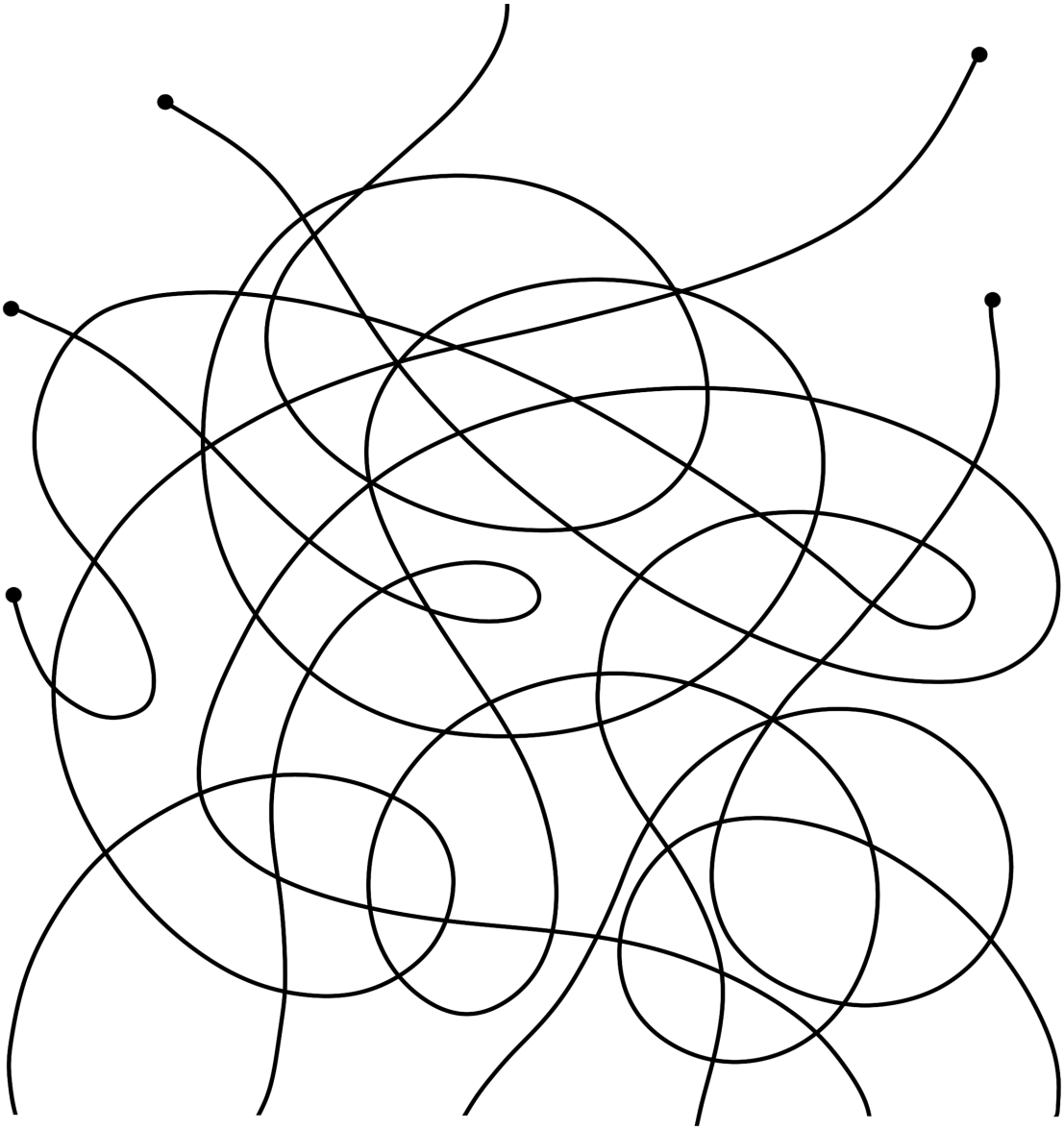


Ground Stations

After Landsat 9 is launched, OLI-2 and TIRS-2 will power up and remotely connect to six stations on the ground. These **ground stations** receive information from the Landsat sensors as they pass overhead, and transfer the data to be organized and stored.

Trace the lines to figure out which ground station Landsat 9 is sending information to!





Fairbanks, Alaska, USA

Svalbard, Norway

Alice Springs, Australia

Fairbanks, Alaska, USA

Neustrelitz, Germany

Sioux Falls, South Dakota, USA

Data Communication

But communication isn't a one-way street! The scientists and engineers who work at the ground stations communicate back and forth with Landsat. If something goes wrong, the people on the ground can put the satellite into Safehold, which is where Landsat stops gathering information until the problem can be fixed. Fortunately, this doesn't happen very often!

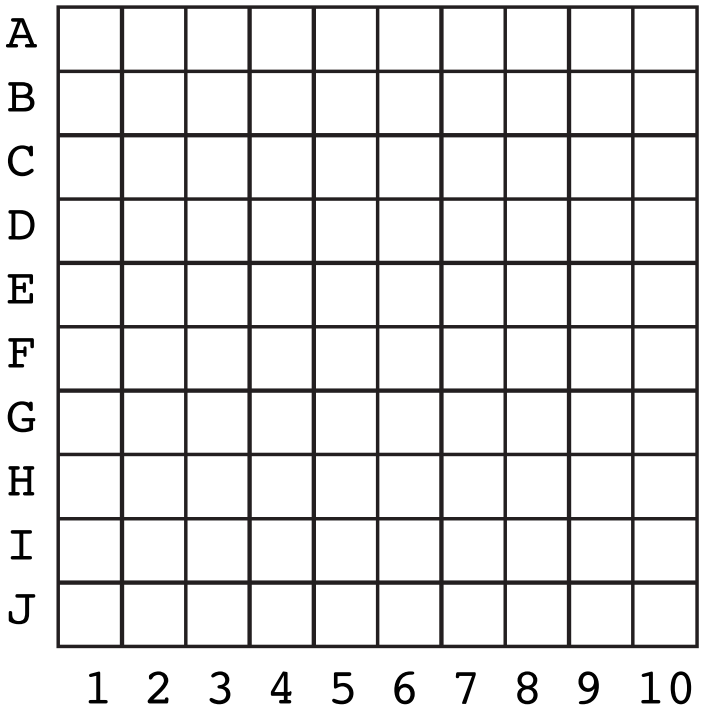
You can simulate satellite communications with a friend!

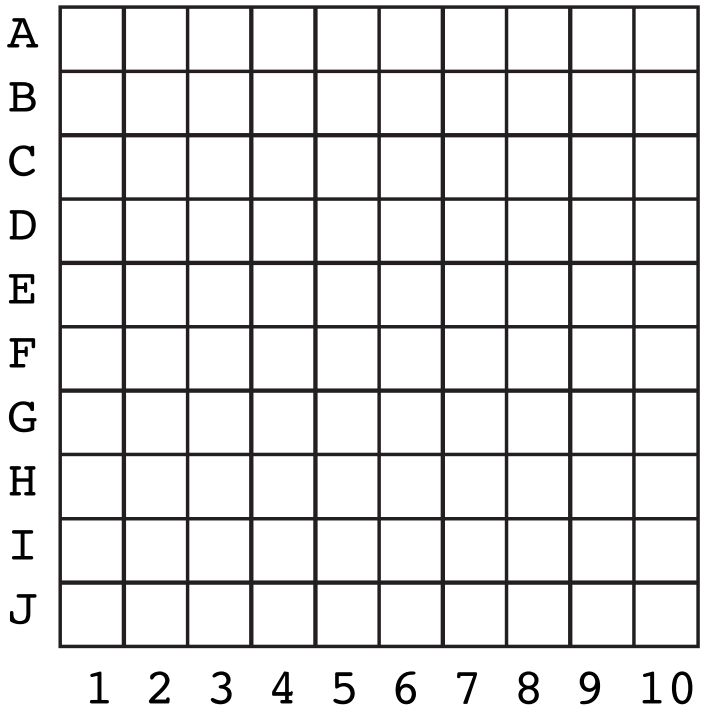
1. Choose one person to be the "satellite" and one person to be the "scientist."

2. Assign each person a grid and make sure that you can't see your partner's grid! The satellite should draw a black and white picture by coloring in full boxes in the grid. Each box should be completely colored in or empty.

3. The scientist will ask about all of the boxes in the grid by reading the letter of the row and the number of the column.

4. The satellite will reply "0" if the box is empty and "1" if the box is full. For example, the scientist could ask about A1 and the satellite could reply "0." Compare your pictures when you're done. Are they the same?





Word Search

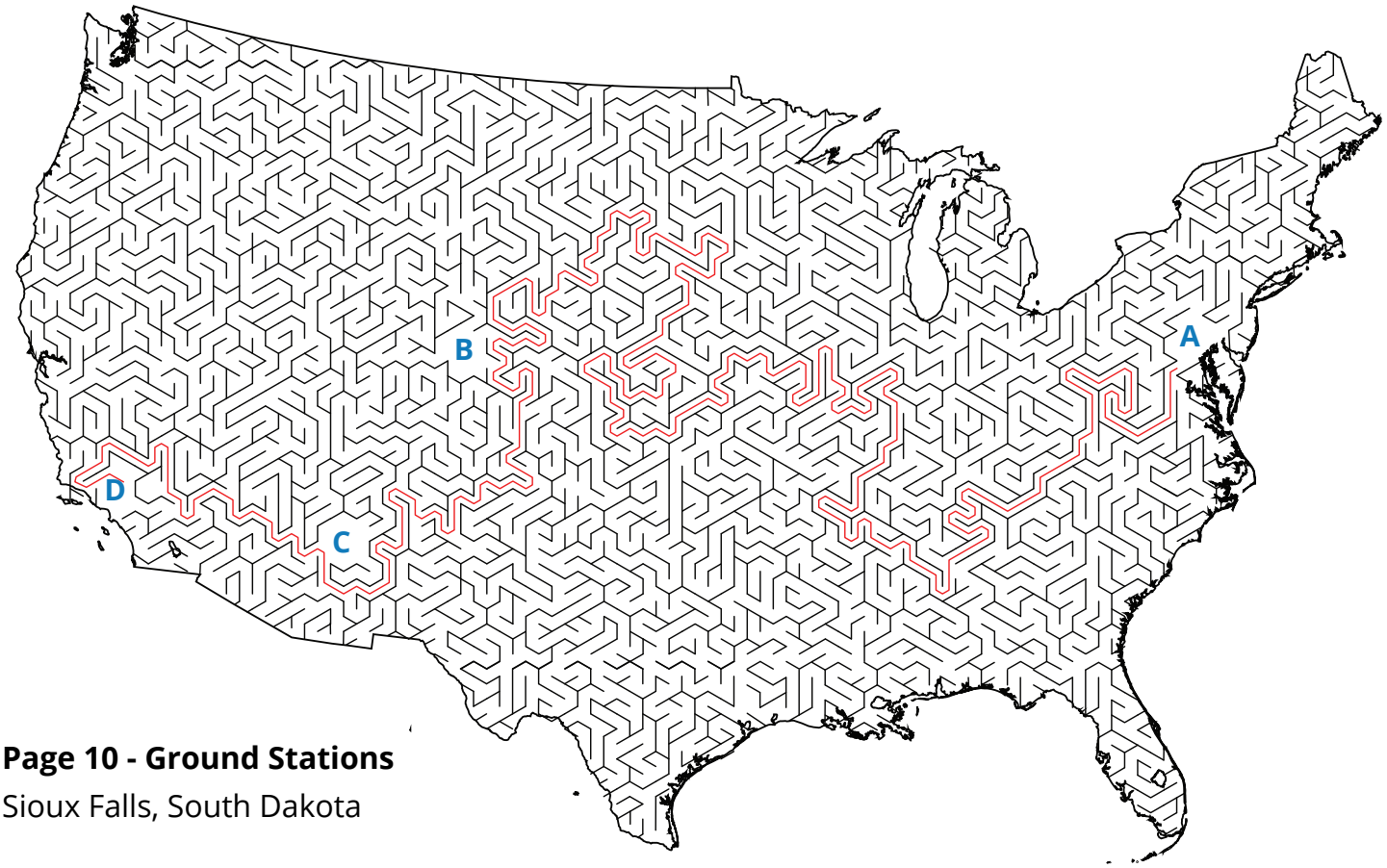
Search for the terms from the key below! Each word is related to Landsat 9 and the data it collects.

N G R D F Q Q F R C G T S V A V H T S V T L J N E
A O Q R O A V I Z E I D E F O R E S T A T I O N M
T Y S D P Z Z H I O M T H R T X Q Q C L Q Z H I I
U L A I T A P S R R C O E N G L L Q O S H H N K T
R O U C R F U L P M E U T N S I Z U X D D N G U R
A N O I T U L O S E R V L E G P I E H O O X W L E
L Z N M G S B E R J U H O A S A E G Q C C L X B V
C A J G X H H N F G Z T Z C P E M C E N W O M J O
O M S K N E D W G A Y R L N D K N O T J T I A P E
L A U A M X U O Z P M A I L C N C S R R R T A X G
O U A O R P N R R M T E A N R O A Z I T A A U P N
R C M I T V Y E F J H N O W U Y B L G N C L N G A
V A I V I D T J C O D I J R D M J N M D G E R W H
T U R O M S W A K S T F P W A E P S J R N U L V C
O O V G A V F E A A L X N V Y O Y L T J D P L E G
C B F S G R P T C F K A X R R I Y E L D A T A F X
U I I S E G O I A E Z C M D B R U T G W D U H O X
B D D M R Z F L K K W N B R A U R J A T S X R G Z
A X D D Y I S L L C H M E L E R E C O V E R Y W L
X H M A S E I E Z Y F D O T H H K D B U Y P X Y U
N Z E S C U J T X G E P R T O A T I X D U K M I P
P Z A O V M H A D R C F K X N W X M X T P U C Y U
G L L Y W T F S M G W C M N O U K D Y G J L N K P
C O S Y K W L N V K S K L Y C L Q B U W D L C N P
R D X P B Q C L P G X M O M C G C K X M Z J N H N

Change over time
Classification
Data
Deforestation
Disaster
Earth
Electromagnetic
False color
Imagery
Land cover
Landsat
Natural color
Polar
Recovery
Remote sensing
Resolution
Satellite
Spatial
Spectral
Thermal

Answer Key

Page 9 - Launch Maze



Page 10 - Ground Stations

Sioux Falls, South Dakota

Page 12 - Word Search

N	G	R	D	F	Q	Q	F	R	C	G	T	S	V	A	V	H	T	S	V	T	L	J	N	E
A	O	Q	R	O	A	V	I	Z	E	I	D	E	F	O	R	E	S	T	A	T	I	O	N	M
T	Y	S	D	P	Z	Z	H	I	O	M	T	H	R	T	X	Q	Q	C	L	Q	Z	H	I	I
U	L	A	I	T	A	P	S	R	R	C	O	E	N	G	L	L	Q	O	S	H	H	N	K	T
R	O	U	C	R	F	U	L	P	M	E	U	T	N	S	I	Z	U	X	D	D	N	G	U	R
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L	Z	N	M	G	S	B	E	R	J	U	H	O	A	S	A	E	G	Q	C	C	L	X	B	V
C	A	J	G	X	H	H	N	F	G	Z	T	Z	C	P	E	M	C	E	N	W	O	M	J	O
O	M	S	K	N	E	D	W	G	A	Y	R	L	N	D	K	N	O	T	J	T	I	A	P	E
L	A	U	A	M	X	U	O	Z	P	M	A	I	L	C	N	C	S	R	R	R	T	A	X	G
O	U	A	O	R	P	N	R	R	M	T	E	A	N	R	O	A	Z	I	T	A	A	U	P	N
R	C	M	I	T	V	Y	E	F	J	H	N	O	W	U	Y	B	L	G	N	C	L	N	G	A
V	A	I	V	I	D	T	J	C	O	D	I	J	R	D	M	J	N	M	D	G	E	R	W	H
T	U	R	O	M	S	W	A	K	S	T	F	P	W	A	E	P	S	J	R	N	U	L	V	C
O	O	V	G	A	V	F	E	A	A	L	X	N	V	Y	O	Y	L	T	J	D	P	L	E	G
C	B	F	S	G	R	P	T	C	F	K	A	X	R	R	I	Y	E	L	D	A	T	A	F	X
U	I	I	S	E	G	O	I	A	E	Z	C	M	D	B	R	U	T	G	W	D	U	H	O	X
B	D	D	M	R	Z	F	L	K	K	W	N	B	R	A	U	R	J	A	T	S	X	R	G	Z
A	X	D	D	Y	I	S	L	L	C	H	M	E	L	E	R	E	C	O	V	E	R	Y	W	L
X	H	M	A	S	E	I	E	Z	Y	F	D	O	T	H	H	K	D	B	U	Y	P	X	Y	U
N	Z	E	S	C	U	J	T	X	G	E	P	R	T	O	A	T	I	X	D	U	K	M	I	P
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G	L	L	Y	W	T	F	S	M	G	W	C	M	N	O	U	K	D	Y	G	J	L	N	K	P
C	O	S	Y	K	W	L	N	V	K	S	K	L	Y	C	L	Q	B	U	W	D	L	C	N	P
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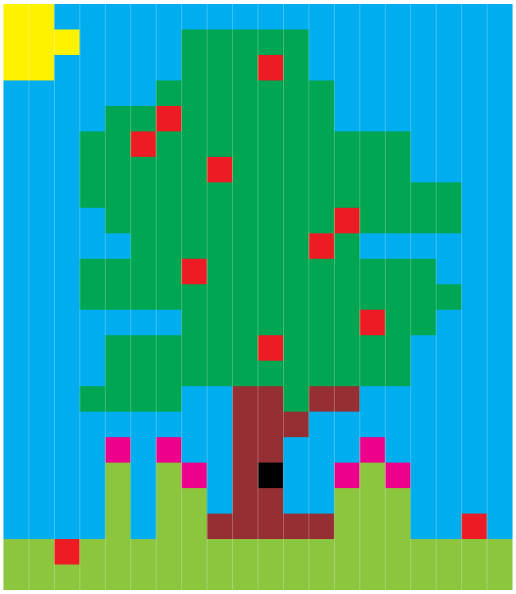
Page 15 - Numbers to Pictures



Explore other games and activities at https://landsat.gsfc.nasa.gov/outreach/landsat-home/

Learn more about Landsat 9 at https://landsat.gsfc.nasa.gov/landsat-9/